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The role of perceived variability in the transition to language*

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ABSTRACT

This article will treat attention to variability as a perceptual structure which mediates the transition from sensorimotor activity to language. The guiding idea is that the attentional system is geared to variability from the very beginning of life and that a speaker's language use is coordinated with this system as it emerges.

UNCERTAINTY, as the term is used in semantic information theory (developed by Carnap & Bar-Hillel (1953)), exists to the extent that there are alternatives in a given referential situation. The alternatives may exist across either space or time. In this theoretical framework, a message element is objectively informative to the extent that it resolves uncertainty by selecting from among the possible alternatives. Uncertainty in information theory does not refer directly to an internal state. It refers rather to external, observable variability that may be hypothesized to induce an internal state called uncertainty. Because it is possible to observe and measure external variability but not internal uncertainty, it may be less misleading to substitute the term VARIABILITY in most contexts where an information theorist might speak of uncertainty.

Probably the most basic form of variability is change. The presence of an object against a plain background creates a visual change at the object's edges – the perceived alternatives are figure and ground. Object movement produces still further change, for movement creates alternative positions across time. According to the research of Kagan and others, these two types of change – contrast and movement – are the prime determinants of visual attention during the opening weeks of life (Kagan 1970*b*). Later in the first year, children build up internalized schemas which form a standard against which change is assessed and, most important, moderate discrepancy from such schemas attracts the infant's attention

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(Kagan 1970*a*). Our hypothesis is that language is from the beginning used selectively where the speaker perceives variability of one sort or another: to mark points of change, deviation from the familiar, choice from among alternatives.

Another way of putting this claim is to say that principles of selective attention become principles of selective word use and that, thus far, the construct encompassing the deployment of attention across the widest range of concrete situations is the concept of variability. Our research has investigated the notion of variability using naturalistic data and experimental techniques. In general we have found that, at the one-word stage, children selectively use their single words to express that aspect of a situation where alternatives exist or where there is change over time (Greenfield & Smith 1976, Greenfield 1978, Greenfield & Zukow 1978).

In our earliest research (Greenfield & Smith 1976, Greenfield 1978), sources of perceived variability were indirectly inferred from an analysis of the naturally occurring referential situation in relation to the child/speaker and his or her utterance. Such analyses provided a rich source of hypotheses, but we have been moving towards more direct tests of our hypotheses – on the one hand, through experimental manipulation of alternatives and change within a potential referential situation; and on the other hand, through observation of the child/speaker's visual attention and behavioural construction of alternatives.

First, an example of experimental manipulation: in a study using mothers (Greenfield & Zukow 1978), we created individualized scripts for mothers based on a particular child's own word use and vocabulary, and embodying particular patterns of constancy and variability. For example, the mother might tell the child to take off a series of items of clothing, e.g. *hat*, *jacket*. Here action is constant, while object of action varies. Or, in the opposite case, she might tell the child to first put *on* a hat and then take it *off*. Now action is variable while object remains constant. A prerequisite for such a procedure is that the child have the vocabulary to express either the change of state (*on*, *off*) or the items of clothing (*hat*, *jacket*, for example). What we have found is that children will selectively imitate the VARIABLE element as the sequence unfolds. Where object varies, the child will mention the object name; where action varies, it will be the action which receives linguistic mention. This type of procedure, while involving experimental manipulation of variability, has the weakness that the variable element in the non-verbal referential situation is also the variable element in the mother's verbal instructions. Systematic data on spontaneous speech production were therefore needed to fill the gap, to demonstrate more conclusively that the child is responding to perceived variability in the non-verbal situation, not merely to perceived variability in language.

The case of the missing agent

Let us therefore proceed to some examples emerging from naturalistic observation. We have observed that, in the one-word stage, so-called 'rich interpretation'

of children's speech reveals very few mentions of an agent, despite the fact that children are often talking about events in which someone, an agent, does something (Greenfield & Smith 1976). A close look at the exceptions to this rule reveals rather special circumstances in which the agent is mentioned, each circumstance related to a particular source of variability. One circumstance is where mention of an agent implies the selection of a preferred agent from an ensemble of alternatives. The following example comes from a few hours spent with an Italian child (pseudonym, Pietro) who was able to produce both single-word utterances and two-word sentences. Because of the observer's limited Italian and interest in agents, a decision was made to focus on the word *mami* ('mommy'), observing its every use. In this time period, there was but a single instance of *mami* in an agent context:

> I asked Pietro if he wanted me to open a juice can he was holding, saying *aperto*? ('open?') and gesturing toward the can. He answered with *mami*, and proceeded to give the juice can to his mother.

In this situation, the child's behaviour indicates that *mami* expresses his preference for his mother as agent, in contrast to the observer as an all-too-real alternative. This example illustrates how the child does not merely use his word to describe an agent who is acting, but rather to select an agent from among a set of possibilities created by the unfolding of events. That is, his mother did many different things within sight of Pietro in the course of the observation; yet he did not say *mami* on these occasions. In this example, the array of alternatives or ENSEMBLE, as it is called in information theory, is inferred from the fact that Pietro responds to the observer's offer, which has implied herself as agent, and hands the juice can to his mother, selecting her as agent.

The child constructs behavioural alternatives

The next example illustrates how the construction of alternatives can be observed more directly in the child's own behaviour. This example is the only other use of *mami* in a single-word utterance in the same time period.

> We have been playing in the park. Pietro has been throwing the ball to various people other than his mother. Now, he gets ready to throw once more, saying *mami*. Then he throws to his mother.

In terms of the behavioural sequence, Pietro has created a set of possible recipients. Examination of his sequential behaviour indicates the ensemble of alternatives. The word *mami* indicates a desired change, as well as a selection from among the ensemble of possible recipients. But this example indicates a limitation to the value of the information theory metaphor for expressing our understanding of what the child talks about. In this case, there are numerically more alternatives (potential recipients) than in the first example (potential

agents). An information theory metric would say that there is therefore more uncertainty – or variability, to use the more objective term. Yet we would not want to claim that the probability of saying *mami* is greater in this situation than in the two-choice one. At this point in the research we limit ourselves to the observation that, in both situations, *mami* functions to select from among alternatives; and that the presence of at least one alternative actor contrasts with other times when mother was carrying out various actions, but Pietro did not use this word.

Selection from alternatives as the ontogenesis of contrastiveness

Chafe's (1976) discussion of how linguistic content is transmitted (by adults) includes discussion of the device of contrastiveness. The function of a contrastive sentence is to assert which candidate is the correct one. The correct candidate is called the FOCUS. According to Chafe, contrastiveness occurs against a context of background knowledge, which includes a list of possible candidates. According to Chafe, too, contrastiveness is a status not of a word but of its referent. From this it follows that the list of possible candidates need not exist on the linguistic level but may exist in the perceptual and/or enactive construction of the situation. Hence, Pietro's use of *mami* to select an agent from a limited set of possible agents, against background knowledge of the ball game, conforms to Chafe's definition of contrastiveness. An important difference remains: Chafe's notion is defined in terms of the speaker's knowledge of what is contrastive for the listener. It depends on inferences by the speaker about the listener. Our hypothesis is that contrastiveness begins its ontogenetic life independent of speaker inferences about the listener, determined only by what is contrastive for the speaker in terms of his or her construction of the situation (e.g. Pietro's implicit list of possible recipients of the ball and his assertion of *mami* as the correct one). This hypothesis is in line with the body of evidence that children only gradually decentre from their own points of view as their linguistic communication develops.[1] It follows that the young child-speaker can linguistically select a contrastive focus without necessarily considering whether the listener has the same list of possible candidates in mind. But what is contrastive for the speaker is often the same as what is contrastive for the listener, and successful communication from child to adult may hinge on this fact.

Adults, too, may rely on similarity between their own state of awareness and that of their listeners whenever possible. The state of the listener may well be computed as a separate state of affairs only when the speaker has reason to believe

[1] Greenfield & Dent (1979) experimentally demonstrated that the linguistic communication of six- and ten-year-olds is influenced by differences in visual information available to the speaker, even when the speaker knows exactly what visual information is available to the listener, and this information does not change.

the listener differs from himself or herself in lacking some relevant item in immediate awareness. The existence of adult egocentricism (cf. Elkind 1967) bears testimony to this idea of speaker- rather than listener-oriented devices by which background context influences what is being said.

According to Chafe, the focus of contrast is, in adults, generally distinguished by higher pitch and stronger stress. Our hypothesis is that this stronger emphasis is conveyed, at the one-word stage, by linguistic realization itself, for the background information remains unexpressed. Thus Pietro's *mami* could become *I throw to MAMI* at a more advanced stage of linguistic expression. In this hypothetical example, some of the background knowledge of the ball game is expressed in *I throw*, unrealized in the one-word version.

Subjective uncertainty made explicit in a question

Two-word utterances open up the possibility of making subjective uncertainty linguistically explicit. The only other use of *mami* during this observation period is in a two-word utterance and illustrates another sort of perceived uncertainty. The situation is as follows: Pietro's mother has just left the terrace (where the three of us have been) to answer the phone. Pietro asks *dove mami*? ('where's mommy?'). Here the additional word, the interrogative 'where' makes linguistically explicit Pietro's uncertainty about his mother's location. This example relates more to uncertainty in the everyday sense of the word. Berlyne (1974) connects this everyday meaning of uncertainty to the information theory concept by saying that the objective variability measured by information theory is usually what causes human uncertainty; i.e. uncertainty is the subjective result of variability in the outside world. Indeed, in the example under consideration it is external variability in the form of mother's change of location from inside to out which occasions Pietro's *dove mami* ('where's mommy?').

These three examples gain additional force from the fact that this is an exhaustive list of occasions on which the word *mami* was used within the observed time period. In addition, because an advance decision was made to observe the usage of this particular word, there was no *ex post facto* selection of data.

The missing agent: a perceptual hypothesis

But let us return now to the conclusion from earlier research that agents are rarely expressed in one-word utterances (Greenfield & Smith 1976, Greenfield & Zukow 1978). Why is this the case, especially considering the often observed fact that children talk about action? What seems to happen at the one-word stage, for example, is that the message gets expressed by the action word alone rather than agent; e.g. Nicky, one of the children in the 1976 study, says *up* climbing up a chair rather than *Nicky*. The situation is similar with an agent other than himself. When his friend Matthew is whining, he says *crying* rather than *Matthew*.

An explanation for this phenomenon will be developed in terms of patterns of visual attention, as these are affected by habituation to the familiar and an orienting response to the novel. This argument draws on the research of Robertson & Suci (1980). These investigators find that when children at the one- and two-word stages watch filmed action involving an agent acting on an animate recipient in the presence of a bystander (that is, one puppet pushing another with a third looking on), they selectively attend to the agent rather than to the other two participants. And this tendency continues over several repetitions of the same action by the identical agent. But it is just such repeated watching which leads to habituation. And indeed, habituation to the agent, as assessed by heart rate measurement, is another phenomenon that manifests itself in their experiment. Jeffrey's (1968, 1976) serial habituation hypothesis is relevant here (as suggested by Pea (1979)). This hypothesis, confirmed in a number of studies of young infants, states that habituation to the initially most salient feature of a stimulus enhances the possibility of orientation to other features of the same stimulus. Here is a hypothetical picture of how this would apply to the infant who continues to watch the agent as action unfolds and is repeated. The invariant features of the agent would cease to attract focal attention whereas changing features would – and action represents just such change. Hence, the child who keeps his or her visual regard on a familiar agent over a period of time may well be orienting to action rather than agent, the agent dropping to background awareness. This orientation to the changing element would then be reflected in the child's deployment of the single word to express what is being done rather than who is doing it. Here is an attentional explanation of the general preference to verbalize action rather than agent when the one-word child is commenting on a situation involving an animate being engaging in an action. The more exceptional circumstances, analyzed earlier, involving a CHOICE of agents would, in contrast, stimulate the linguistic realization of an agent.

Visual orientation and verbalization

Our most recent study incorporated direct examination of visual orientation in relation to word use. Some videotapes were made of children playing with their mothers. Play involved toys which were all familiar and nameable by the child. Each mother presented a scripted series of actions for the child to imitate. Within a particular series something varied (e.g. recipient of action) while other characteristics remained constant (e.g. action). An example of this would be a routine in which the mother fed the same food to a series of different animal puppets. In this sequence, agent, action, and object remain constant while patient or recipient of action varies. Although the children often departed from the script, it did provide a semi-structured framework for the analysis of word use. The mothers were, moreover, instructed not to describe objects or actions verbally. Unlike the earlier study using selective imitation, therefore, variability in the event was independent of variability in the linguistic cues.

Let us consider one of the children in this study, a boy of 1 ; 6. He was the only one whose father was present during the experimental session. Let us compare his patterns of visual attention and linguistic reference to his mother with those to his father. During the session, Ben (a pseudonym) has his attention focused on his mother most of the time. He is either looking at her from very close by (at a conversational distance) or is on her lap. While he has the word *mommy* in his lexicon, he never uses it in the session. His father, in contrast, is at a distance from Ben. Ben does not seem aware of his presence at first. He has been playing with his mother at the beginning of the session. For some reason he turns and catches sight of his father in the corner of the room. He points to him and walks towards him repeating ***daddy***, ***daddy***, ***daddy***, ***daddy***, although, when he reaches his father, he does not appear to want his father or want him to do anything. Here, an observable orienting response (head turning) is joined with linguistic expression. And, indeed, this is the only time the word ***daddy*** is used during the session. Orientation to what, in this situation, is a new and possibly unexpected entity, appears to stimulate naming. Daddy is not mentioned again, thus confirming the role of novelty in visual orientation and speech. In sum, Ben never mentions his mother, although he interacts with her constantly, whereas he does mention his father despite the fact that he only notices him once and they never really interact.

The unimportance of importance in selective word use

This example illustrates how variability cannot be equated with the concept of importance. Indeed entities that are most important to the child – self and mother – may be just those that, under normal circumstances, recede to background awareness just because of their stable presence, i.e. they come to be taken for granted. In the language of pragmatics they are PRESUPPOSED rather than linguistically stated.

This analysis is paralleled by another phenomenon involving inanimate objects. We have found in a series of three studies that inanimate objects are more likely to be named by the child when they are at a distance from the child rather than in hand.[2] In line with my explanation in terms of visual orientation and habituation, tactile contact with the object in hand should stimulate habituation and withdrawal of the object into background awareness. Once again, the child should orient to change – here, to any change of state intended or produced in the object in hand. If language follows this orienting response, the child should comment on the change, while not mentioning the object itself. And this is exactly what we have found. A particularly interesting example comes from our longitudinal study.

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[2] Bruner, Caudill & Ninio (1975) have found that pre-verbal pointing, an indexical behaviour that precedes labelling in development, also occurs in response to objects that are out of reach.

There are two kinds of car. One is the toy car Matthew is playing with inside the house. The other is real cars which can be heard to pass outside.

As Matthew plays with the car in hand, he never mentions it, only talking about the action changes he is producing, expressed in words like *bye bye*, *beep beep*, *down* (throwing it). Yet every time he hears a car pass outside his response is to name it saying *car*.

The car in hand comes to be taken for granted, habituated in attentional terms, and goes unmentioned. I infer that the cars outside, occasional and unseen, elicit an orienting response. And, correlatively, this orienting response is marked by the child's use of an identifying label. Once again, too, the child names what is less important in terms of relevance to his personal world (the passing car which he never tries to approach physically) while leaving unsaid what is of greater personal importance (the toy car in hand).

Constancy vs. change: the ontogenesis of the 'given-new' distinction

The example of *daddy*, above, could be used to illustrate the ontogenesis of the GIVEN-NEW distinction as articulated by Chafe (1976: 30): 'Given (or old) information is that knowledge which the speaker assumes to be in the consciousness of the addressee at the time of the utterance. So-called new information is what the speaker assumes he is introducing into the addressee's consciousness by what he says'.

As in the case of contrastiveness, the hypothesis is that this distinction starts out and remains basically a speaker-oriented concept, without reference to the listener. This leads to a modification of the definition of GIVEN information to: knowledge that is already in the speaker's background awareness before the referential event occurs; NEW information is then what is introduced into focal attention by the referential event. Thus the mother, in the example above, is already a given at the time the observation session begins, whereas the father is observably introduced into the child's consciousness, as Ben's visual orientation to his father shows. Chafe gives as an example of old information the situation where, before the utterance, the speaker has seen the listener look at some object and therefore pronominalizes it. Our example, analyzed from a speaker-oriented perspective, would stress that, because the child-speaker has, up to the present, been in a communicative relationship with the mother, she has become a given and he therefore does not refer linguistically to her at all. (Omission of old information precedes its pronominalization developmentally (Skarakis & Greenfield 1979).)

As for adult forms of expression, Chafe states that given information is conveyed in a weaker and more attenuated manner than new information. In one-word utterances, this attenuation of given information is carried to the extreme

of disappearance: it remains unsaid. This is nicely illustrated by the child's general tendency to verbalize action while omitting agent when describing his or her own action. Self, in the background of awareness, a constant for the child, is given and goes unsaid. The action, representing a change of state, is what is new for the child. As such it gets verbalized.

There is a refinement which this article introduces into Chafe's notion of consciousness – the distinction between background awareness and focal attention. These concepts bring Chafe's ideas into closer relation with psychological concepts and allow his distinction between given and new information to be more readily applied to perception of the extralinguistic context.

The construction of novel alternatives: evidence against situational determinism

An exception to the rule about not mentioning what is in hand illustrates how novel alternatives can always be constructed by the child, and that the principle of using language informatively is not a sort of situational determinism. In this example, Ben starts with a cookie in his right hand. He then says *dog*, moving the cookie from right to left hand, preparing to take the dog in the right hand. He says *dog* again while it is in hand. Although he names what is in hand, he has, through his action, constructed two alternative objects which can be held in his right hand, thus counteracting the tendency for object in hand to be taken for granted. (Next, putting the dog down, he says *kie* (seeming to be a short form of *cookie*) signalling a change of the cookie back to the right hand.) This example nicely illustrates Olson's (1970) theory of semantics, which stresses that words are used not simply to refer but also to partition alternatives.

The use of the first person possessive

Finally, it will be shown how the use of words to mark change or to partition alternatives holds across a wide range of semantic functions by examining the use of the possessives *my* and *mine* by one child in the most recent study. While there were many things belonging to this child (who shall be called Rena) in the room during the type of structured play already described, the possessive forms *my* and *mine* were not used to identify them. Instead these words were applied to objects (sometimes hers, sometimes not) that were in her mother's possession, as she grabbed them away. So *my* and *mine* were not used to describe a state of affairs but rather to mark a change of possessive state, the act of taking possession, making something hers. Thus, the first person possessive was not used where possession could most be taken for granted – to mark the child's own toys, for example – but rather where it was most variable and therefore most in question.

Another example (from informal observation of the author's nephew Daniel,

age 1 ; 9) illustrates the interesting (albeit less common) use of the possessive to partition alternatives:

> Daniel, in the kitchen, communicates that he wants some raisins. His mother gives him two identical tiny boxes of raisins, telling him one is for him and one is to give to his friend (age 2), who is on the porch, out of sight. Holding one box in each hand, Daniel holds out one to his mother and says *my*. His mother agrees, and Daniel leaves the kitchen.

Differentiation of the identical boxes is required by Daniel's goal of getting some raisins and by the task set by his mother (and seemingly accepted by Daniel) of giving a box of raisins to his friend. The use of *my* partitions the alternatives that have arisen relative to this goal structure.

The partitioning of alternatives reappears in an important way in early dialogue (Greenfield & Smith 1976). When Nicky is 1 ; 8, his mother points to her books and says *Those are mine*. Nicky then points to his own books and says *Nini* (Nicky). This dialogue clearly implies an ensemble of books partitioned by the possessive terms.

Dialogue and uncertainty

In adult-initiated question-answer dialogue, furthermore, the question establishes certain information as given while identifying an area of uncertainty. Thus, what has been taken for granted earlier by the child is now put into words by an adult interlocutor. As Clark & Haviland (1977) put it, 'questions have given information, but in place of new information they have wanted information'. Just as novelty was encoded a few months earlier in response to visually or enactively presented situations, now the child provides new information in response to a linguistic situation. By new is meant information not contained in the question itself, the wanted information. For example, I ask Matthew, age 1 ; 8.26, *where does it go*? referring to a puzzle piece and he answers *here*, pointing to the correct hole. Thus the tendency to omit information already obvious on the perceptual level is now repeated in response to the linguistically given information of a question. What is presupposed by the question is omitted in the answer. This strategy can be seen as the earliest manifestation of Grice's (1975) conversational maxims relating to quantity: make your contribution no less but no more informative than is required (for the current purpose of the exchange). Matthew is limited to an 'elliptical' one-word answer by his stage of language development. His choice of words however reflects attention to the given-new distinction. However, as in most cases of question-answer dialogue, what is given (the question) is available to both speaker and hearer. Hence it is impossible to say whether the speaker is adapting his or her speech specifically to the listener's point of view.

Further developmental continuities

The influence of orientation to change persists in our language usage as adults, indicating its important place in linguistic pragmatics. Vygotsky (1962: 139) pointed this out in this example from his classic *Thought and language*:

> Now let us imagine that several people are waiting for a bus. No one will say, on seeing the bus approach, 'The bus for which we are waiting is coming'. The sentence is likely to be an abbreviated 'Coming', or some such expression, because the subject is plain from the situation.

In this setting – waiting for a bus – the constant, what can be taken for granted, is not mentioned; the change is. Adult ellipsis thus depends on perception of a non-verbal situation; it is a cognitive matter, not merely a linguistic one. Wertsch, in a recent paper (1977) reminds us that inner or private speech, Vygotsky's language of self-instruction, also omits what is already known (what Vygotsky calls the psychological subject), and includes what is new (Vygotsky's psychological predicate).

In conclusion, selective attention to change, variation, and novelty appears as important in language use as in perception. At this point in our research, we need better and more independent measures of orienting and attending while language is being produced. If such research should bear out our findings up to this point, then attention to variability will furnish an important bridge from sensorimotor functioning to language.

REFERENCES

Berlyne, D. E. (1974). Information and motivation. In A. Silverstein (ed.), *Human communication: theoretical explorations*. Hillsdale, N.J.: Erlbaum.

Bruner, J., Caudill, E. & Ninio, A. (1975). Language and experience. The John Dewey Lecture.

Carnap, R. & Bar-Hillel, Y. (1953). *An outline of a theory of semantic information*. Technical Report No. 247, Research Laboratory for Electronics, Massachusetts Institute of Technology.

Chafe, W. L. (1976). Giveness, contrastiveness, definiteness, subjects, topics, and point of view. In C. Li (ed.), *Subject and topic*. New York: Academic Press.

Clark, H. H. & Haviland, S. E. (1977). Comprehension and the given-new contrast. In R. O. Freedle (ed.), *Discourse production and comprehension*. Norwood, N.J.: Ablex.

Elkind, D. (1967). Egocentricism in adolescence. *ChDev* **38**. 1025–34.

Greenfield, P. M. (1978). Informativeness, presupposition, and semantic choice in single-word utterances. In N. Waterson & C. Snow (eds), *Development of communication: social and pragmatic factors in language acquisition*. London: Wiley.

Greenfield, P. M. & Dent, C. (1979). A developmental study of the communication of meaning: the role of uncertainty and information. In P. French (ed.), *The development of meaning*. Japan: Bunka Hyoron.

Greenfield, P. M. & Smith, J. H. (1976). *The structure of communication in early language development*. New York: Academic Press.

Greenfield, P. M. & Zukow, P. G. (1978). Why do children say what they say when they say it?: an experimental approach to the psychogenesis of presupposition. In K. Nelson (ed.), *Children's language*, Vol. 1. New York: Gardner Press.
Grice, H. P. (1975). Logic and conversation. In P. Cob & J. L. Morgan (eds), *Syntax and semantics*. Vol. 3: *Speech acts*. New York: Academic Press.
Jeffrey, W. E. (1968). The orienting reflex and attention in cognitive development. *PsychRev* **75**. 323–4.
—— (1976). Habituation as a mechanism for perceptual development. In T. J. Tighe & R. N. Leaton (eds), *Habituation: perspectives from child development, animal behavior, and neurophysiology*. Hillsdale, N. J.: Erlbaum.
Kagan, J. (1970*a*). Attention and psychological change in the young child. *Science* **170**. 826–32.
—— (1970*b*). The determinants of attention in the infant. *AmSci* **58**. 298–306.
Olson, D. R. (1970). Language and thought: aspects of a cognitive theory of semantics. *PsychRev* **4**. 257–73.
Pea, R. (1979). Can information theory explain early word choice? *JChLang* **6**. 397–410.
Robertson, S. S. & Suci, G. J. (1980). Event perception by children in the early stages of language production. *ChDev* **51**. 89–96.
Skarakis, B. & Greenfield, P. M. (1979). The role of old and new information in the linguistic expression of language-disabled children. Paper presented at the Fourth Annual Boston University Conference on Language Development, Boston.
Vygotsky, L. S. (1962). *Thought and language*. Cambridge, Mass.: M.I.T.
Wertsch, J. V. (1977). Inner speech revisited. Paper presented at the biennial meeting of the Society for Research in Child Development.